

WE CLAIM:

1. A valve comprising a valve body, said valve body comprising:

- 5 (a) ^a feedstock conduit;
 ▷ (b) ^a venturi flow conduit in contact at ^{an} intersection with said feedstock conduit, and
 ▷ adapted to suck feedstock fluid through said feedstock conduit, ^{the} force of said sucking dependent
upon flow through said venturi flow conduit;

- ▷ (c) ^a bypass flow conduit adapted to conduct bypass fluid through said valve; and
10 ▷ (d) ^{an} adjustable first flow controller to control flow of said bypass fluid.

15 ▷ 2. A valve according to claim 1 comprising ^a retentate release conduit adapted to
conduct flow of concentrate fluid from said valve body.

3. A retentate release conduit according to claim 2 comprising ^a second flow
controller for said concentrate fluid from said valve body.

4. A retentate release conduit according to claim 2 comprising means to minimize
pressure drop of said retentate when said flow of retentate is removed from said valve body.

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5. Means to minimize pressure drop according to claim 4 comprising spring and
piston.

6. A valve according to claim 1 comprising inflow conduit downstream from said intersection.
7. A valve according to claim 1 comprising first pressure sensor to measure pressure of said flow through said venturi flow conduit at a position upstream from said intersection.
8. A valve according to claim 1 comprising second pressure sensor downstream from said intersection.
- 10 9. A valve according to claim 1 comprising temperature sensor to measure temperature of said bypass fluid.
- 15 10. A valve according to claim 1 comprising flow sensor to measure flow of said feedstock fluid.
11. A fluid filtering system adapted to separate a permeate from a feed stock fluid, said system comprising: (a) a valve according to claim 1, (b) a single pump (c) a filter.
- 20 12. A fluid filtering system adapted to separate a permeate from a feed stock fluid, said system comprising: (a) single pump (b) filter (c) said valve of claim 3 wherein said feedstock conduit connects to sump tank containing feedstock and said flow control valve for concentrate connects to concentrate collection tank.

13. A fluid filtering system adapted to separate a permeate from a feed stock fluid,
said system comprising: (a) single pump (b) filter (c) said valve of claim 6; said fluid filtering
system comprising at least one retentate conduit circuit adapted to recirculate flow of a retentate
fluid through said single pump adapted with said valve wherein at least one element selected
5 from the group including of (a) said bypass flow conduit of said valve (b) said venturi flow
conduit of said valve and (c) said inflow conduit of said valve, connect to at least one element
selected from the group including said pump and to said filter.

14. A fluid filtering system adapted to separate a permeate from a feed stock fluid,
10 said system comprising: (a) single pump (b) filter (c) said valve of claim 7 wherein said first
pressure sensor is attached to a microprocessor.

15. A fluid filtering system adapted to separate a permeate from a feed stock fluid,
said system comprising: (a) a single pump, (b) a filter, (c) a valve according to claim 9 wherein
15 said temperature sensor is attached to a microprocessor.

16. A fluid filtering system adapted to separate a permeate from a feed stock fluid,
said system comprising: (a) single pump (b) filter (c) said valve of claim 10 wherein said flow
sensor is attached to a microprocessor.

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17. A fluid filtering system according to claim 11 wherein said filter is selected from
reverse osmosis filters, nanofiltration filters, ultrafiltration filters and microfiltration filters.

18. A fluid filtering system according to claim 11 wherein said filter is a cross flow filter.

19. A fluid filtering system according to claim 11 wherein said pump comprises ^a third pressure sensor to measure outflow pressure of said pump.

20. A fluid filtering system according to claim 11 wherein said pump comprises ^a 1 sensor to measure horsepower of said pump.

10 21. Apparatus for continuously separating feedstock fluid mixture into purified fluid mixture and residual fluid mixture, said apparatus assembled so that said residual fluid mixture is recirculated within two recirculating loops with common, single means to mix together and recirculate said residual fluid mixture within said recirculating loops, said first recirculating loop comprising:

15 a. means to separate and remove said purified fluid mixture from said residual fluid mixture, rate of said separation dependent upon pressure of said residual fluid within said first recirculating loop;

b. means to remove a portion of said residual fluid mixture from said first recirculating loop, said means to remove located downstream from said means to separate;

20 said second recirculating loop comprising:

i. means to suck (pull) said feedstock fluid mixture into said second recirculating loop, so that said feedstock fluid mixture becomes mixed with part of said

residual fluid mixture, the force of said means to suck controlled by flow of said residual fluid mixture within said second recirculating loop;

- ii. means to bypass a portion of said residual fluid mixture around said means to suck, said bypass having means to control said flow of residual fluid mixture controlling sucking force, and control pressure of said residual fluid mixture within said first recirculating loop;

5 wherein the rate of separation in the separation means is dependent upon said means to control pressure within the first recirculating loop.

10 22. Apparatus of claim 21 wherein said means to suck is a venturi.

23. Apparatus of claim 21 wherein said means to control said pressure and flow of said residual fluid mixture is a control valve.

15 24. Apparatus of claim 21 wherein said means to recirculate is a centrifugal pump.

25. Apparatus of claim 21 wherein said means to separate is a cross flow filter.

20 26. An Apparatus of claim 21 wherein said cross-flow filter comprises a filter selected from the group consisting of reverse osmosis filters, nanofiltration filters, ultrafiltration filters and microfiltration filters.

27. Apparatus of claim 21 wherein all outflow from said filter of said residual fluid

mixture is removed from said apparatus without recirculating within said apparatus.

28. Apparatus for continuously separating feedstock fluid mixture into purified fluid mixture and residual fluid mixture, said apparatus assembled so that said residual fluid mixture is recirculated within two recirculating loops with common, single means to mix together and recirculate said fluid residual mixture within said recirculating loops, said first recirculating loop comprising:

- a. means to separate and remove said purified fluid mixture from said residual fluid mixture;
- b. means to remove a portion of said residual fluid mixture from said first recirculating loop, said means to remove located downstream from said means to separate ;
- c. means to control pressure of said residual fluid in first recirculating loop, and flow of said residual fluid mixture in second recirculating loop, said means to control pressure and flow located downstream from said means to separate;
said second recirculating loop comprising:
- d. means to suck (pull) said feedstock fluid mixture into said separating means, so that said feedstock fluid mixture becomes mixed with part of said residual fluid mixture, the force of said means to suck controlled by flow of said residual fluid mixture within said second recirculating loop.

29. Apparatus of claim 28 wherein said means to suck is a venturi.

30. Apparatus of claim 28 wherein said means to control said pressure and flow of said residual mixture is a control valve.

31. Apparatus of claim 28 wherein said means to recirculate is a centrifugal pump.

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32. Apparatus of claim 28 wherein said means to separate is a cross flow filter.

10 33. Apparatus of claim 28 wherein said cross-flow filter comprises a filter selected from the group consisting of reverse osmosis filters, nanofiltration filters, ultrafiltration filters and microfiltration filters.

15 34. A process of using a control valve in a process of filtering a fluid in a system comprising a filter, a venturi in fluid communication with inflow of fluid to be filtered, at least one fluid recirculation loop, said process comprising the steps of (a) positioning said control valve, said venturi, and said filter within said at least one fluid recirculation loop; and (b) operating said control valve to simultaneously regulate outflow from said filter and inflow into said at least one recirculation loops through said venturi.

20 35. A process according to claim 34 wherein said at least one fluid recirculation loop comprises two fluid recirculation loops in fluid communicative contact at one intersection with said control valve positioned in parallel with said venturi in said first fluid recirculation loop and said filter positioned in said second fluid recirculation loop.

36. A process according to claim 34 wherein said at least one fluid recirculation loop comprises two fluid recirculation loops in fluid communicative contact at one intersection with said control valve positioned in series with said filter in said first fluid recirculation loop and said venturi positioned in said second fluid recirculation loop.

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37. A process of using four valves in a process of filtering a fluid in a system comprising a filter, three retentate closed loops in common fluid communicative contact at one intersection, a venturi in fluid communicative contact with inflow of fluid to be filtered, the process comprising the steps of positioning:

- 10 a) first control valve in series with said filter and said common fluid communication at one intersection;
- b) second control valve in series with said filter, said common fluid communication at one intersection, and said venturi positioned in parallel with third flow control valve;
- 15 c) fourth control valve in series with said common fluid communication at one intersection, and said venturi positioned in parallel with said flow control valve;
- d) closing said first control valve, closing said fourth control valve, opening said second flow control valve and operating said third control valve to simultaneously regulate outflow from said cross flow filter and inflow to said two retentate closed recirculation loops through said venturi;
- 20 e) opening said first control valve, opening said fourth control valve, closing said second flow control valve and operating said third control valve to simultaneously regulate outflow from said cross flow filter and inflow to said two retentate closed recirculation loops through said venturi; and

wherein the flow and pressure at the filter is switched to relatively higher pressure and lower flow at said filter thereby cleaning the membranes followed by production of high permeate through put.

5 38. A process according to claim 37 whereby pressure at said filter is made independent at flow of filter by partially or fully opened said four valves.

10 39. The process of determining when to remove retentate from a filtration system, said process consisting of:

- 15 (a) measuring the power use of a single pump within said filtration system comprising single pump, filter, venturi, valves; and
- (b) estimating the viscosity of said retentate knowing said power use by said single pump; and
- (c) estimating contamination of said retentate knowing said viscosity of said retentate.

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